Plant Evaluation Notes

A Bamboo Performance Report

Richard G. Hawke, Coordinator of Plant Evaluation Programs

The mention of bamboo conjures up images of lush, exotic landscapes with towering groves of colorful canes, or perhaps a garden rampantly engulfed by too much bamboo. The invasive nature of bamboo is notorious but with careful site selection bamboo can be a unique component of the landscape or garden. Its merit in the planned landscape is understandable when one considers the variety of textures, colors, forms and sizes that are available. Bamboo is a good substitute for ornamental grasses in shady sites and can be used as screens, specimen plants, groundcovers, potted plants and wateredge plants.

Bamboos are members of the grass family (Poaceae) and are typically described as either running or clump-forming in habit. The running, or monopodial, bamboo spread to form open colonies and have multi branched, sharply pointed rhizomes that allow for ease of movement through hard soils. The clump, or sympodial, bamboo form dense, compact clumps and do not colonize.

In the warm temperate and southern climates of the United States bamboo is often a common element in the landscape. But bamboo in the Midwest? Although this seems an unlikely possibility, bamboo can indeed be found growing in locations throughout the Midwest (Schmidt 1992). Its character in colder regions may not entirely fit either the romantic or infamous image of bamboo but some of its basic traits are evident. Growing bamboo in a cool temperate climate adds an exotic aspect to the landscape and creates a distinctive contrast with other traditional garden plants.

Evaluation Project Initiated

From 1987 to 1992 the Chicago Botanic Garden (USDA Hardiness Zone 5b) grew and evaluated bamboo to determine winter hardiness and overall adaptability to the local climate. Four goals were outlined for the project: 1) to determine culm and rhizome hardiness; 2) to determine adaptability as groundcover plants; 3) to appraise ornamental character; and 4) to assess invasiveness and ease of eradication.

Fourteen bamboo taxa were selected for evaluation and planted in April of 1987 (Table 1). All bamboo were recommended by James W. Waddick, Ph.D., Kansas City, Missouri. The bamboo were planted in Pullman Evaluation Garden, a landscaped setting with trees, shrubs and herbaceous plants that provided different light exposures.

Twelve species were grown in a common bed with exposures ranging from full sun to full shade (Table 3). Approximately three-quarters of the bed was shaded for at least 50% of the day. The remaining portion received full sun all day. *Pleioblastus argenteostriatus* and *P. viridistriatus* were grown in separate beds receiving full sun throughout the day.

The soil base was clay loam with leaf mold and horse manure added as organic modifiers. The pH during the evaluation period ranged from 7.8 in 1987 to 7.3 in 1991, a decrease attributable in part to the application of granular sulfur to lower the pH level throughout Pullman Evaluation Garden. A general fertilizer was not

R. Hawke

Sasaella masamuneana var. *albostriata*

T. Clark

Pleioblastus viridistriatus growing with *Pterostyrax hispidus* in the Pullman Evaluation Garden.

applied during the evaluation term. Supplemental irrigation was given to the bamboo in the first year and in subsequent years whenever needed. The water requirements of the other plants in the garden provided sufficient incidental moisture to the bamboo during the evaluation period. The development of bamboo requires adequate moisture during the three to five year establishment period (Koller 1989). The beds were top-dressed with composted and shredded leaves each spring and fall, but were not given extra winter protection.

Each taxon was represented by three plants, with the exception of *Pleioblastus argenteostriatus* and *P. viridistriatus* which had 12 and 15 plants, respectively. Planting was done in early April of 1987 while the plants were dormant. Rhizome development was not obstructed by the placement of barrier material at planting time, although metal or heavy plastic barriers are recommended to limit the growing area of a running bamboo (Royal Horticultural Society 1992). Rhizomes were allowed to grow uninhibited in the test sites so that lateral growth could be measured.

The planting beds for *Pleioblastus argenteostriatus* and *P. viridistriatus* were isolated from other areas by pre-existing physical barriers. The selection of these bamboo for separate sites was arbitrary and based solely on the quantity of plants available. One border of the bed containing *Pleioblastus argenteostriatus* was separated from an adjacent bed by railroad ties and a drop in planting level of 45.8 cm (18 in.). It was bordered on the other side by brick paving and a gravel walk. The bed containing *P. viridistriatus* was raised above the main bamboo bed and surrounded by railroad ties.

Evaluation Report

Evaluation began in 1987 and for the first two years all bamboo remained clump-like in habit. In 1989 canes began to emerge in neighboring beds, turf areas or among other plants, sometimes up to 3.04 m (10 ft.) from the original site. Generally, the bamboo with well-defined boundaries appeared more vigorous than bamboo without distinct boundaries. The barriers caused the rhizomes to turn and grow back into the bed creating a full, "pot bound" effect.

In five years, the running bamboo had spread freely and at various rates through the main bed. The bamboo were dug out in March of 1992, with care to remove as much of the rhizome system as possible. All remaining culms, arising from isolated rhizomes, were treated twice with a 2% solution (8 oz./3 gal. of water) of Roundup® or pulled after emerging. These management efforts quickly controlled regeneration from relic rhizome pieces, and by the fall of 1992 all bamboo appeared to be eliminated.

The plant characteristics and performance specifics of the bamboo observed from 1987 to 1992 are outlined in Table 3. Several species that were part of the initial evaluation died before the termination date and are noted in the report text but not included in Table 3. Nomenclature follows The New Royal Horticultural Society Dictionary of Gardening.

Table 1: Bamboo Test Group

Arundinaria gigantea
Phyllostachys bissettii
Phyllostachys nuda
Phyllostachys rubromarginata
Pleioblastus angustifolius
Pleioblastus argenteostriatus
Pleioblastus pygmaeus
Pleioblastus viridistriatus
Pseudosasa japonica
Sasa kurilensis
Sasa palmata
Sasaella masamuneana var. *albostriata*
Shibataea kumasasa
Thamnocalamus spathaceus

Arundinaria gigantea (Walt.) Muhlenb.
Not overly vigorous in the trials. Moderate spreading, but not consistent in stem height.

Phyllostachys bissettii McClure
An especially rampant species with arching stems; runners up to 3.04 m (10 ft.) long. In 1991, the average height was 91.4 cm (36 in.) tall but up to 155.1 cm (61 in.) tall growing in the shade. Approximately 25% of the foliage held green through the winter; foliage was not damaged by the hard frost (27°F) on October 16, 1991.

Phyllostachys nuda McClure
Similar to *P. bissettii* in habit and character. New shoots deep burgundy. Spread throughout the planting bed and into adjacent beds. In 1991 the culms measured up to 175.3 cm (69 in.) tall with several culms 7 mm (1/4 in.) in diameter due to minimal die back in the winter of 1990-91. The tallest and most robust bamboo in the trials.

Phyllostachys rubromarginata McClure
Dieback during the winter of 1990-91 was variable with 10% of the foliage holding green. A vigorous, widely spreading species with runners up to 1.21 m (4 ft.) long in the second season. Leaves remained green following the hard frost in October of 1991, whereas the leaves of *Arundinaria* and *Pleioblastus* species were damaged.

Pleioblastus angustifolius (Mitf.) Nakai
Similar in appearance to *P. pygmaeus* and intermixed with this species. *Pleioblastus* species typically die back to the ground during the winter (see comments for *P. argenteostriatus*).

Pleioblastus argenteostriatus (Regel) Nakai
Attractive, full planting throughout the evaluation period; the second best bamboo overall. In the winter of 1990-91, only 50% of the culms died to the ground; remaining culms were green but a majority of the leaves dropped. The silverish-white variegation was variable over the entire planting and was at times weak. Moderately aggressive; some movement into surrounding beds and gravel walk.

Pleioblastus pygmaeus (Miq.) Nakai
Leaves hold tan and drop in the spring. Moderate spreading; runners averaged 30.5 cm (12 in.) long.

Pleioblastus viridistriatus (Siebold) Mak.
The best performance overall; consistently a full, dense planting. Vigorous species; spread into adjacent turf area and down into a bed 45.8 cm (18 in.) lower. Excellent foliar character with variable-width bands of golden-yellow.

Pseudosasa japonica Mak.
Moderate to weak growth, up to 12.7 cm (5 in.) tall. All plants dead in 1990. Minimum winter temperature 0°F. (American Bamboo Society 1988).

Sasa kurilensis (Rupr.) Mak. et Shib.
Weak growth through first several years. All plants dead in 1990. Minimum winter temperature 0°F. (American Bamboo Society 1988).

Sasa palmata E. Camus
Not aggressive in the trials. Began to spread in the second season. Bold textured foliage - 25.4 cm (10 in.) long and 51 mm (2 in.) wide. Severe rabbit damage to emerging culms greatly decreased the effect in 1990. Plants never seemed to regain vigor. In 1991, only the culms growing in the heavily shaded and protected area at the back of the bed remained; the original clumps in full sun had died.

Sasaella masamuneana var. *albostriata* (Muroi.) D. McClintock
Attractive white or cream variegation. Foliage remained green with only minor winter injury in 1987-88. Complete stem die back in subsequent seasons except 1990-91 when approximately 20% of the culms remained green. In 1991 the encroaching culms of *Pleioblastus viridistriatus* and *P. pygmaeus* masked the foliar effect. It spread approximately 91.4 cm (36 in.) upward into an adjoining raised bed.

Shibataea kumasasa (Zoll. ex Steud.) Mak. ex Nakai
Weak growth in first two years, then began to decline in 1989. Foliage always scorched; located in full sun. Thought to have died out in 1990, but in 1991 several robust culms were found growing with *Pleioblastus pygmaeus*. Poorly sited and too much competition from other plants.

Thamnocalamus spathaceus (Franch.) Soderstr.
Non-vigorous clump form. Measured 28 cm (11 in.) tall in the first several years following planting, but only 10.2 cm (4 in.) tall in 1990. Died over the winter of 1990-91. Minimum winter temperature -20°F. (American Bamboo Society 1988).

The American Bamboo Society has established minimum temperature ranges for many commercially available bamboo (American Bamboo Society 1988). This information is noted in Table 3 and can be compared with the lowest winter temperatures recorded on-site (Table 2).

Table 2: Winter Weather Data for 1987 to 1992

Winter	Lowest temp. °F	# of days at 0°F or below
1987-88	-13	16
1988-89	-5	4
1989-90	-15	8
1990-91	-6	4
1991-92	-8	2

Data obtained from the Chicago Botanic Garden weather station. Latitude: 41°51'N. Longitude: 87°37'W. Altitude: 176.4-190.35m (624-669 ft. a.s.l.)

Conclusions

The results of the five year evaluation conclude that bamboo can be grown successfully in the Chicago region and the Midwest. Within the test group the majority of plants showed complete rhizome and root hardiness. Conversely, with few exceptions, culm hardiness was not reliable and marginal in the best of years (see Table 3). *Phyllostachys bissettii* and *P. nuda* displayed the greatest promise for culm and foliar hardiness. Protected environments may contribute to greater success with individual species.

The groundcover potential of several species, in particular *Pleioblastus argenteostriata* and *P. viridistriatus*, is evident from the trial results. Other vigorous, running bamboo observed in the trial group demonstrated potential as groundcovers. Optimum growth habit may not have been achieved for several reasons, including an unrestrained growing area that allowed rhizomes to cover great distances before sending up culms, and planting certain species incorrectly in full sun.

The ornamental effect, size and coloration of bamboo canes is not reliable in colder climates. Therefore, foliage becomes the most significant ornamental characteristic. The variegated species are especially important in this respect. Bamboo offers many textures, colors and leaf sizes, and provides an exotic impact in the garden.

Barriers appeared to enhance the character of the planting, create a better groundcover effect and decrease the invasive nature of the rhizomes. Bamboo can be recommended for use in the landscape as groundcover plants with careful siting and placement of barriers to restrict invasiveness. Eradication was successful through a management program utilizing mechanical and chemical methods.

The top five bamboo for overall ornamental quality and groundcover potential were: *Pleioblastus viridstriatus, Pleioblastus argenteostriatus, Phyllostachys nuda, Phyllostachys bissettii* and *Sasaella masamuneana* var. *albostriata.*

In conclusion, bamboo can be recommended and successfully utilized in the midwestern landscape provided care is taken in its selection, placement and management.

Pleioblastus or *Arundinaria*?

by James W. Waddick, Ph.D.[1]

Bamboo names have been and are in a confused state. *Arundinaria* was proposed for the single North American species, *Arundinaria gigantea*, by Michaux in 1803. As more bamboos became known to European science, all were put in the genus *Arundinaria*. These species were later transferred to more than two dozen new genera. The relationships are unclear, but it is safe to include only *A. gigantea* in the genus *Arundinaria*. One of the new genera is *Pleioblastus* (Nakai 1925) comprised of small to medium, hardy running species from Japan and China. All the common dwarf hardy bamboos are in this genus. In commercial nursery and garden usage the two genera are synonymous, but I recommend use of the genus *Pleioblastus* for clarity.

[1] James W. Waddick is co-author of Iris of China (Timber Press 1991) and author of a forthcoming book on bamboo from Timber Press.

Table 3: Characteristics and Performance Specifics of Bamboo Species at the Chicago Botanic Garden, 1987-1992.

	Habit	Average Height[1]	Foliage Color	Winter Color	Hardiness	Minimum Temp. °F[7]	Vigor	Exposure[8]	Groundcover Recommendation
Arundinaria gigantea	clump[3]	3 91.4-123 cm (36-48 in.)	green	tan	rhizome 100% culm 50%[2]	-10°	no	partial shade	no
Phyllostachys bissetii	running	91.4-115 cm (36-45 in.)	green	tan	rhizome 100% culm 75%[2]	-10°	yes	shade/sun	yes
Phyllostachys nuda	running	102-176.3 cm (40-69 in.)	green	tan	rhizome 100% culm 75%[2]	-20°	yes	shade	yes
Phyllostachys rubromarginata	running	91.4-108 cm (36-42 in.)	light green	tan/ green	rhizome 100% culm 50%[2]	0°	yes	shade/sun	yes
Pleioblastus angustifolius	running	30.5-45.7 cm (12-18 in.)	green	tan	rhizome 100% culm 0%	n/a	no	partial shade	no
Pleioblastus argenteostriatus	running	56-66 cm (22-26 in.)	green w/ silverish-white	tan	rhizome 100% culm 50%[2]	10°	yes	sun	highly
Pleioblastus pygmaeus	running	25.4-50.8 cm (10-20 in.)	green	tan	rhizome 100% culm 0%	10°	yes	shade/sun[4]	yes
Pleioblastus viridistriatus	running	76-86.3 cm (30-34 in.)	green w/ golden yellow	tan	rhizome 100% culm 0%	0°	yes	shade/sun	highly
Sasa palmata	running	38.1-45.7 cm (15-18 in.)	green	tan	rhizome 50%[5] culm 0%	-5°	no	shade/sun[4]	undetermined
Sasaella masamuncana var. *albostriata*	clump/ running	30.5-45.7 cm (12-18 in.)	green w/ white	tan/ green	rhizome 100% culm 50%[2] leaves 90%[6]	0°	yes	sun	yes
Shibataea kumasasa	running	23-25.4 cm (9-10 in.)	green	tan	rhizome 100% culm 0%	-5°	no	sun	undetermined

[1] Average height observed at Chicago Botanic Garden trial site from 1988 to1992.
[2] Culm hardiness 0% in most years; citations for the winter of 1990-91 only.
[3] Clump-like in habit, slowly spreading by runners.
[4] Prefers a shaded site; plants were robust in shaded areas of the bed or when growing within another bamboo.
[5] The original plant died during the third winter and the plants arising from the rhizomes remained.
[6] Leaves held green and healthy through the winter of 1987-88.
[7] An estimate of the temperature at which some damage occurs due to cold (American Bamboo Society 1988).
[8] Exposure expressed as average percent during a day: shade/sun is 50/50%; partial shade is less than 50%; sun or shade is 100%.

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To receive a list of nursery sources, send a self addressed stamped envelope to the address below.
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